X-721-67-552

NASA TM X-63277

CAPACHE PAYLOAD RECOVERY SYSTEM

DECEMBER 1967

NASA

GODDARD SPACE FLIGHT CENTER

GREENBELT, MARYLAND

X-721-67-552

CAPACHE PAYLOAD RECOVERY SYSTEM

SERVICE MANUAL
PART NUMBER
SGC-856-SM2

December 1967

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONTENTS

CONTENTS (Continued)

APPENDIXES

ILLUSTRATIONS

Section 1
DESCRIPTION

1.1 INTRODUCTION

This technical manual provides servicing and adjustment instructions for the Capache payload-recovery system (Figure 1-1). The system is used to recover the payload of small-diameter sounding rockets of the Nike-Cajun or Nike-Apache class.

1.2 SYSTEM DESCRIPTION

The recovery system consists of the following assemblies and components:

a. Parachute assembly

b. Severance-section assembly

c. Forward-adapter ring

d. Sequencer assembly

e. Housing assembly

The system is 18.75 inches long, 6.75 inches in diameter, and weighs approximately 28 pounds.

1.2.1 PARACHUTE ASSEMBLY

The parachute assembly (Figure 1-2) consists of the parachute and the parachute cylinder.

1.2.1.1 Parachute. Initial stabilization and deceleration are provided by a flat circular parachute (drogue chute), 5 feet in diameter, which is connected to the main parachute by an 8.5-foot bridle. The main parachute canopy is a solid 10-percent-flat extended-skirt type, 14.9 feet in diameter, with alternate gores of white, orange, and metallized silver which aid visual and radar tracking of the main parachute.

Deployment bags are provided for each of the parachute canopies. The deployment bag for the main parachute has an integrated reefing ring/line system

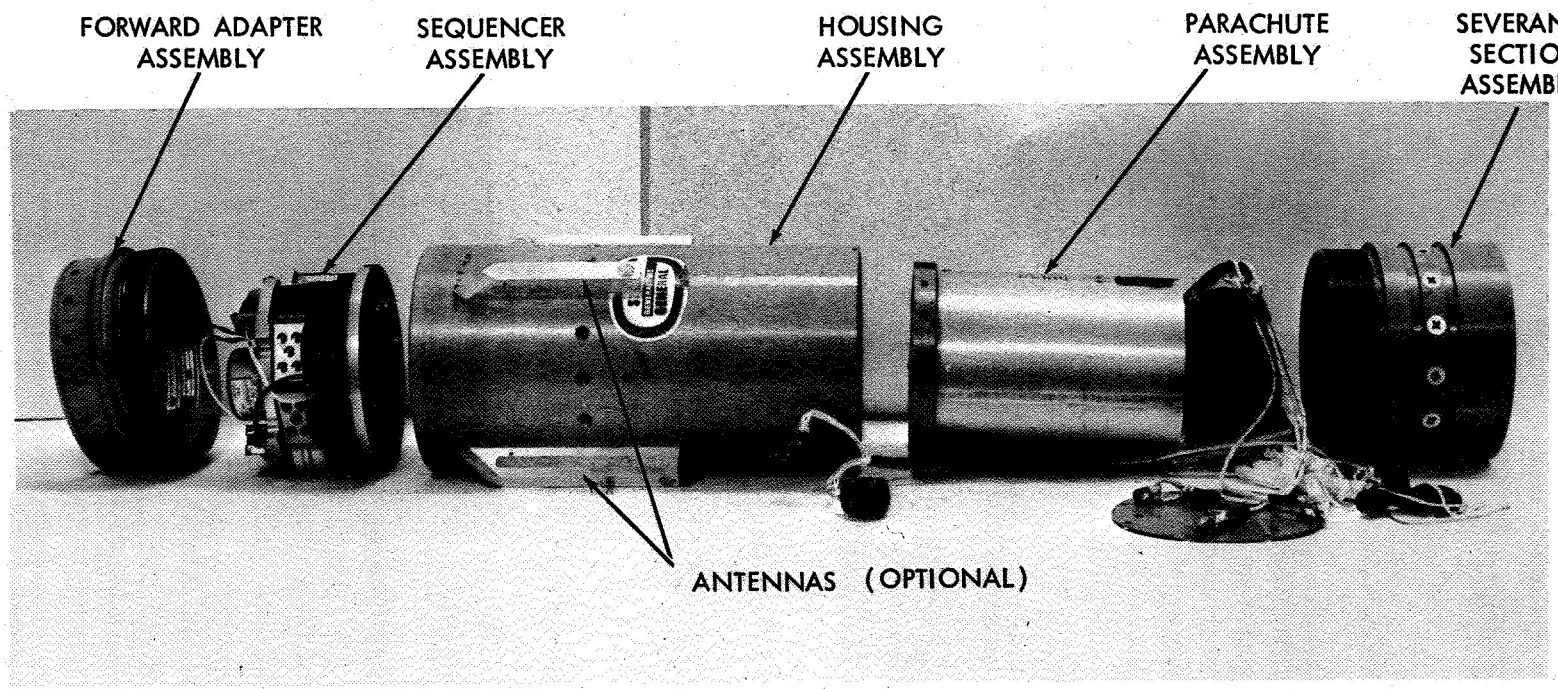


Figure 1-1. Capache Payload Recovery System

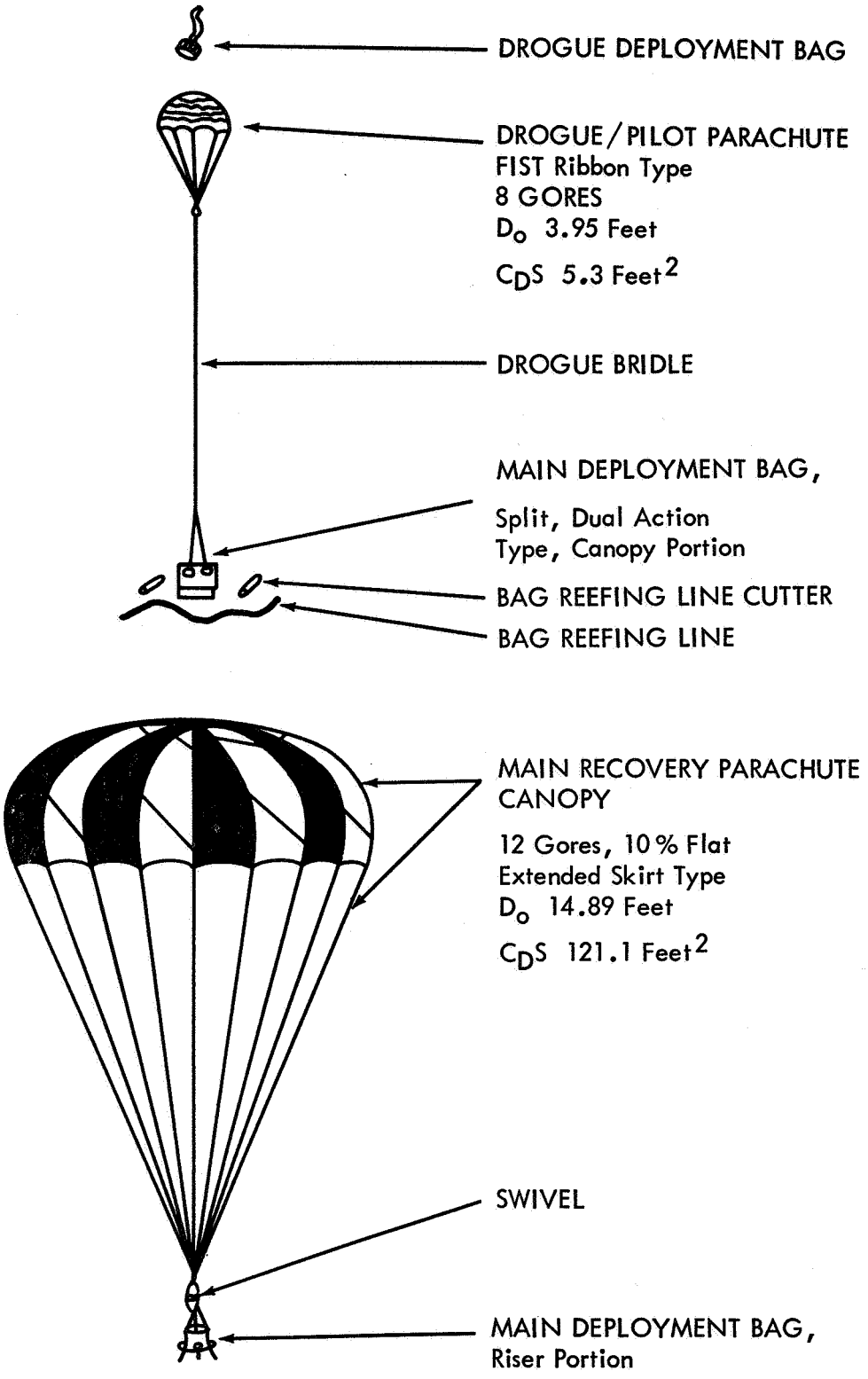


Figure 1-2. Parachute Assembly

equipped with two 10-second-duration mechanically actuated pyrotechnic cutters, only one of which is required for operation.

1.2.1.2 Parachute Cylinder. The parachute cylinder is a tubular canister having, as the parachute retraining plate, a riveted base plate. The complete cylinder is attached to the inside of the housing assembly.

1.2.2 SEVERANCE-SECTION ASSEMBLY

The severance-section assembly consists of a coupling ring, shaped-charge retaining ring, cover plate, and pyrotechnic devices (detonators and shaped charges). This assembly is the aft interface of the recovery system and mates with the second-stage rocket motor. Detonation of one explosive charge within the assembly separates the recovery system and payload from the second-stage rocket motor; detonation of a second explosive charge removes the aft cover plate and lower ring, allowing the drogue chute to deploy.

1.2.2.1 Coupling Ring. The coupling ring houses the components of and is the main body of the severance-section assembly. Internal threads at the ring's aft end and external threads at its forward end provide a means of attaching the coupling ring between the second-stage rocket motor and the recovery-system housing assembly.

1.2.2.2 Shaped-Charge Retaining Ring. A retaining ring is used to hold the shaped charges. Four detonators, connected to the internal portion of the retaining ring, are used to ignite the 15-grain-per-foot, flexible, linear-shaped charges.

1.2.2.3 Aft-Cover Plate. A removable cover plate permits access to the aft portion of the recovery system and installation of the detonators after recovery system assembly. The cover plate is attached to the shaped-charge retaining ring and is ejected by ignition of the aft shaped charge to allow drogue chute deployment.

1.2.3 FORWARD-ADAPTER RING

The forward-adapter ring, the forward interface of the recovery system, mates with the payload.

1.2.4 SEQUENCER ASSEMBLY

The sequencer assembly supplies the necessary relay logic and power to initiate the first and second severance functions and contains and supplies power to an optional radio beacon to aid in retrieval of the payload. An electronic

timer initiates the first severance signal; a barometric-sensing unit initiates the second severance signal. One cable assembly connects the sequencer assembly (Figure 1-3) to the severance-section assembly detonators.

1.2.4.1 Electric-Power Supply. Six nickel-cadmium rechargeable batteries, consisting of 10 cells each, supply electric power to the system. Each cell provides 0.25 ampere-hour at 1.25 volts. Two of the batteries (B1), which are series-connected, provide power for the timer, barometric-sensing unit, and beacon; the other four batteries (B2 through B5) supply power to the four severance-section detonators.

1.2.4.2 Electronic-Timer Unit. The solid-state electronic-timer unit puts out the signal for first severance. This timer is adjustable from 170 to 500 seconds by changing resistance external to the timer. Before flight, the timer on each recovery system must be properly adjusted.

1.2.4.3 Barometric-Sensing Unit. The barometric-sensing unit consists of four 20,000- and four 50,000-foot, series parallel-connected altitude switches and six relays. This unit initiates signals which, at the proper altitude, enable the severance-section-assembly detonators. The unit later initiates a signal to detonate the second severance detonators at the proper altitude.

1.2.4.4 Radio-Beacon Unit (Optional). The solid-state CW radio beacon, which requires 24 vdc for operation, is connected to two diametrically opposed quadra-loop antennas mounted on the outside of the housing assembly. Once energized, the beacon will transmit for approximately 8 hours.

1.2.5 HOUSING ASSEMBLY

The housing assembly, an aluminum cylinder, contains all components of the recovery system. The forward adapter ring mates to the forward end of the assembly; the severance-section assembly mates to the aft end of the assembly. When telemetry or beacon antennas are required, they may be attached to the outside of the housing assembly.

1.3 SEQUENCE OF OPERATION

A typical sequence of events for a flight using the Capache payload recovery system is Figure 1-3 which shows a schematic diagram of the sequencer assembly; Figure 1-4 illustrates the sequence of events.

a. The rocket is launched and starts the upward leg of the trajectory.

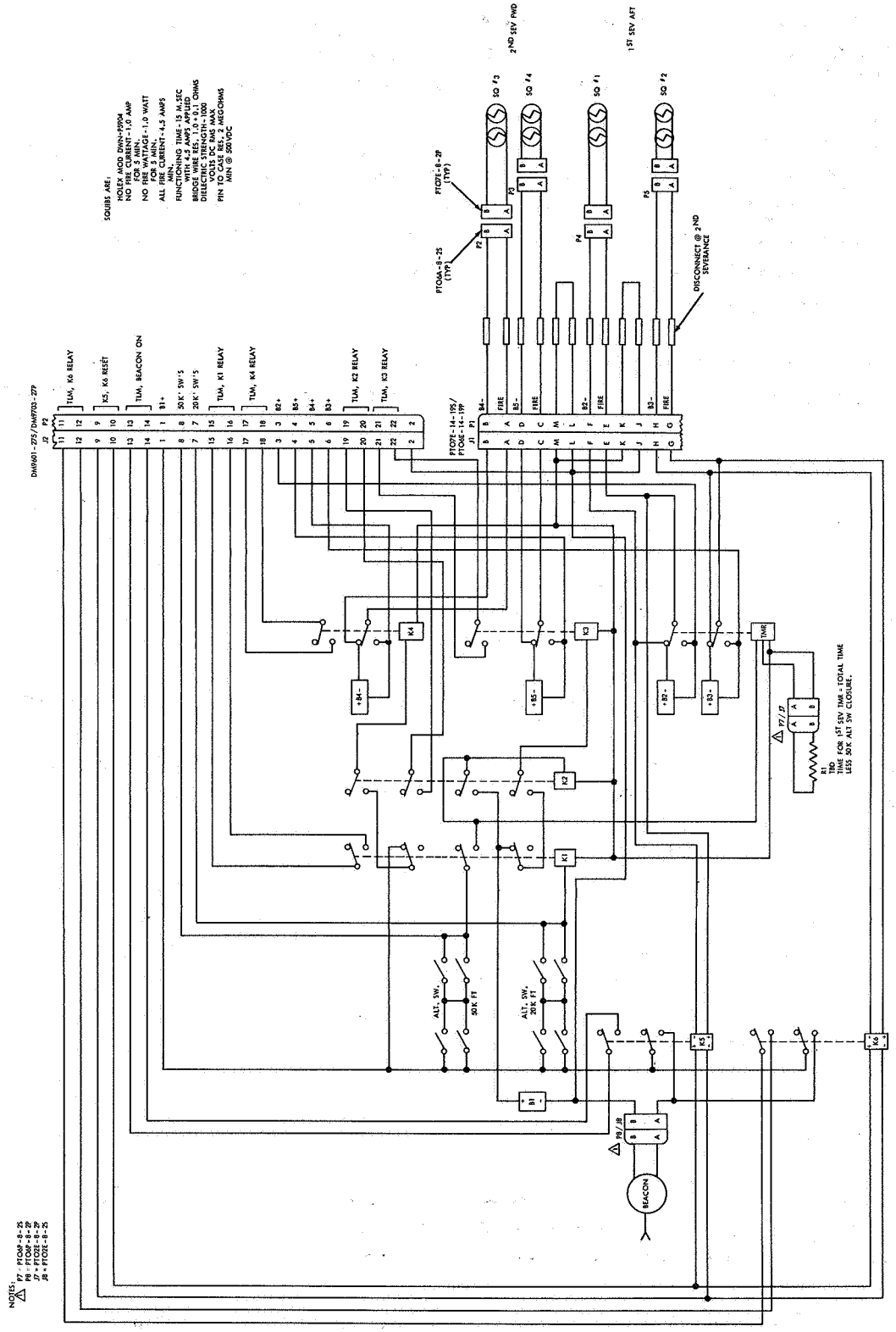


Figure 1-3. Sequencer Assembly, Schematic Diagram

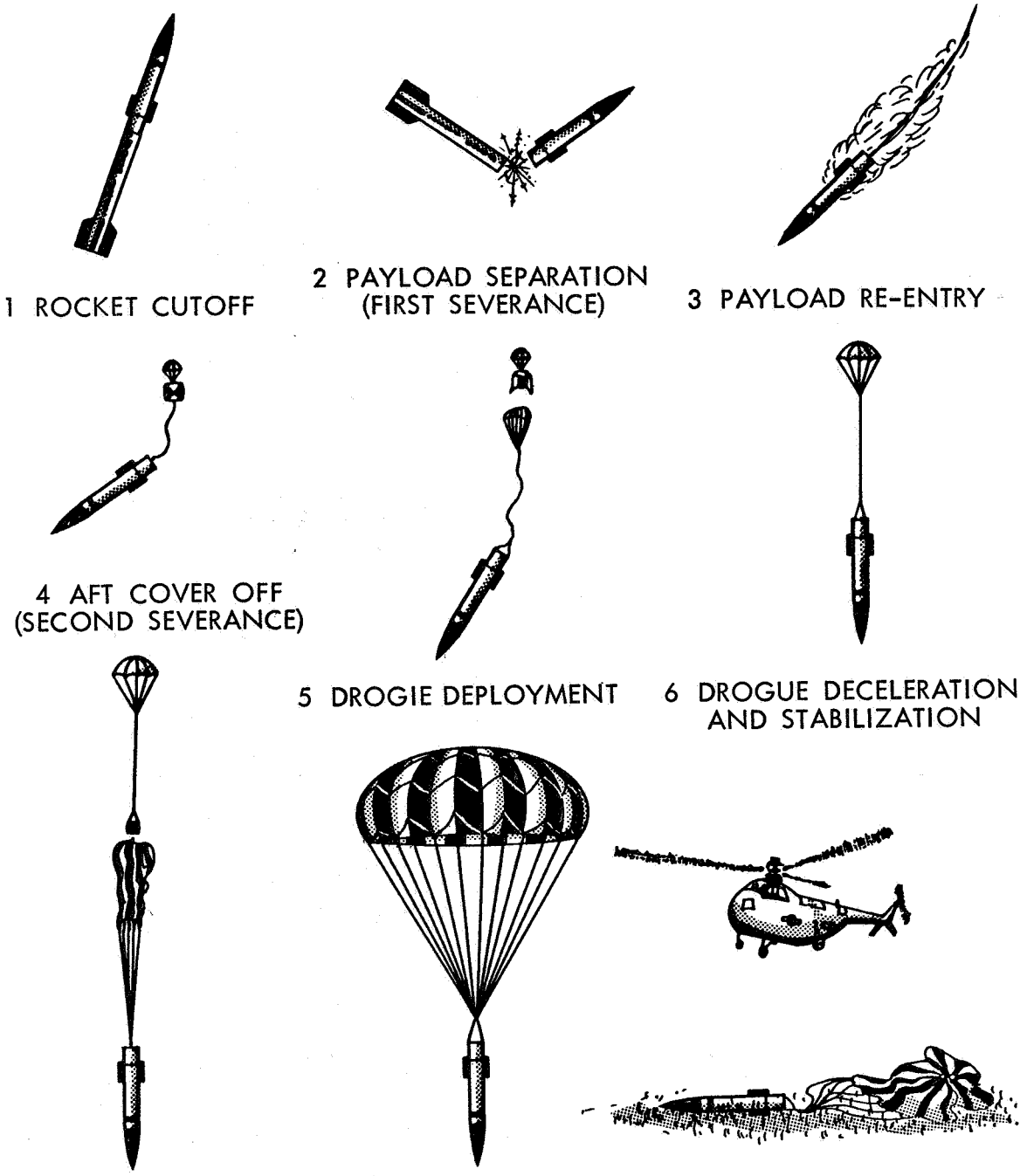


Figure 1-4. Sequence of Events for a Typical Flight

b. At 20,000 feet, the 20,000-foot altitude switches close, energizing relay K1 and making power available for relay K2.

c. At 50,000 feet, the 50,000-foot altitude switches close, energizing relay K2, starting the electronic timer, and enabling the severance-section detonators.

d. When apogee is reached, the vehicle starts the downward leg of the trajectory.

e. At a predetermined time (in relation to altitude), the electronic timer initiates completion of the B2 and B3 battery circuits. Battery power applied to detonators 1 and 2 acts to detonate the aft shaped charge and separate the payload and recovery-system package from the rocket. Completion of battery circuits B2 and B3 also energizes relays K5 and K6 which supply power from battery B1 to the optional radio beacon.

NOTE

The nominal first-severance altitude is approximately 350,000 feet. Exact altitude is determined by the individual rocket trajectory.

f. The falling payload and recovery system package tumbles in a flat spin, greatly reducing the velocity of the package.

g. At 20,000 feet, the 20,000-foot altitude switches open to de-energize relay K1, energize relays K3 and K4, and apply battery power to detonators 3 and 4, which detonate the forward charge. This charge expels the aft cover and ring into the airstream, pulls the reefing-line cutter pins, and releases the drogue parachute and bridle. Release of the drogue chute disconnects the aft electrical wiring and ground-looping system from the sequencer assembly. All relays are then de-energized, except K5 and K6 which are latching relays that supply power to the optional radio beacon.

h. Opening of the drogue chute stabilizes the tumbling package and decelerates it to a nose-down position.

i. Ten seconds after the aft cover is expelled, the reefing-line cutters on the main parachute-deployment bag sever the reefing line. Drogue-chute drag deploys the main parachute.

j. The main parachute decelerates the package to a sea-level descent velocity of approximately 25 feet per second.

Section 2
CHECKOUT AND ADJUSTMENT

2.1 GENERAL

This section contains procedures for the initial checkout and adjustment of the recovery system. When a recovery system is received from the Contractor, these procedures should be performed in the order shown.

Data sheets A1 and A2, shown in Appendix A, have step designations corresponding to the step designations in the procedures. When a step in the procedure designates record, the required information should be recorded in the space provided on the data sheet. Data sheet A1 should be used, except where data sheet A2 is specified in the battery test. The data sheets, when completed, will become a part of the recovery-system package and must accompany the recovery system until final checkout before launch.

2.2 PROCEDURES

2.2.1 DISASSEMBLY

Disassemble the recovery system as follows:

a. Loosen 14 retaining screws around outside of housing assembly.

b. Remove 8 screws and lock washers, securing aft cover plate to shaped charge retaining ring, and remove aft cover plate.

CAUTION

Do not pull on the reefing lines. Failure to comply will result in actuating the reefing-line cutters, which would render the system inoperable.

c. Disconnect drogue-chute lines from cover plate.

d. Unscrew severance-section assembly from housing assembly.

e. Unscrew forward adapter ring from housing assembly.

f. Remove 14 retaining screws around outside of housing assembly.

g. Remove parachute assembly and sequencer assembly from aft end of housing assembly.

h. Disconnect cables from antenna connectors on inside of housing assembly.

i. On sequencer assembly, remove P1 from J1.

j. Remove 6 screws and flat washers that attach sequencer assembly to parachute assembly.

k. Record radio-beacon unit (optional) serial number and frequency on data sheet A1.

l. In recovery system, visually inspect for and correct pinched wires, damaged connectors, battery leakage, droque-chute packaging, loose reefing line cutters, and other damage (sign and date data-sheet A1 in space provided).

m. Check for continuity between P1-B and P2-B, and between P1-A and P2-A—label connector P2 as 2ND SEV FWD.

n. Check for continuity between P1-D and P3-B, and between P1-C and P3-A—label connector P3 as 2ND SEV FWD.

o. Check for continuity between P1-F and P4-B, and between P1-E and P4-A—label connector P4 as 1ST SEV AFT.

p. Check for continuity between P1-H and P5-B, and between P1-G and P5-A—label connector P5 as 1ST SEV AFT.

2.2.2 BATTERY CHARGING AND TEST

Charge and load-test the batteries as follows:

a. Charge batteries at 20 to 25 ma for approximately 24 hours. (B1 should be charged to 28 volts maximum; B2 through B5 should each be charged to 14 volts maximum, 1.4 volts per cell maximum.

b. Assign a unit serial number to each battery, identify batteries with those numbers, and record battery unit serial numbers on data sheet A2.

c. Discharge each battery (at 250 ±10 ma) to minimum of 1 volt per cell (20 volts minimum for B1, 10 volts minimum for B2 thru B5) as follows:

(1) Measure no-load voltage and record on data sheet A2.

(2) Apply load, measure voltage at T + 0 minutes, and record on data sheet A2.

(3) Measure voltage at T + 1 minute and record on data sheet A2.

(4) Measure voltage at T + 3 minutes and record on data sheet A2.

(5) Measure voltage at T + 5 minutes and record on data sheet A2.

(6) Measure voltage every 5 minutes (until T + 50 minutes) and record on data sheet A2.

(7) Replace each battery that has discharged to below 1 volt per cell and repeat steps a through c for each new battery.

d. Repeat step a.

e. Connect sequencer assembly to land-recovery-system test set (GSFC drawing number GDZ-12-207C) as shown in Figure 2-1.

f. Set test set AC-OFF switch to AC position (AC PWR and BATT CHARGE OFF indicators illuminate.

g. Set BATT SEL switch to B1x2 position and record voltage (VOLTAGE MONITOR meter should indicate 26 volts minimum).

h. Set and hold BATT TEST switch to LOAD TEST position (after 30±5 seconds, VOLTAGE MONITOR meter should indicate 23 volts minimum) then release BATT TEST switch and record voltage.

i. Momentarily set BATT TEST switch to RESET position.

j. Set BATT SEL switch to B2 position.

k. Momentarily set BATT TEST switch to LOAD TEST position (LOAD TEST indicator illuminates).

l. Momentarily set BATT TEST switch to RESET position (LOAD TEST indicator extinguishes).

m. Set BATT SEL Switch to B3 position.

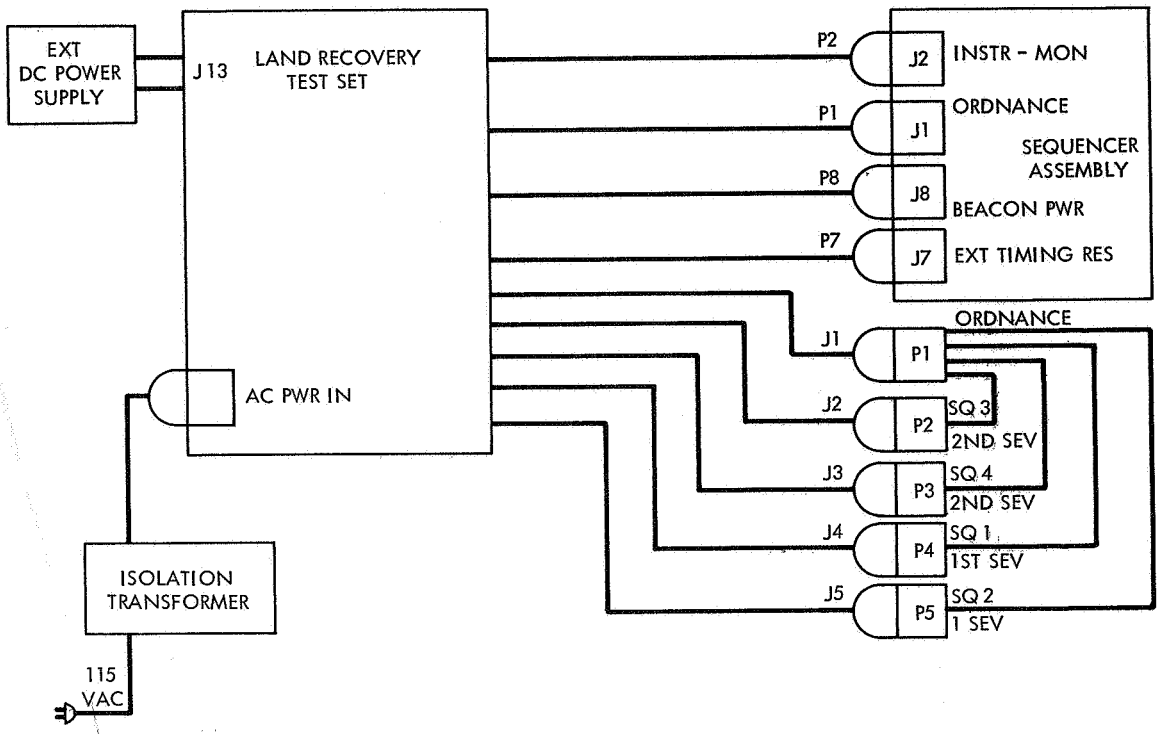


Figure 2-1. Initial Test Setup

n. Repeat steps k and l.

o. Set BATT SEL Switch to B4 position.

p. Repeat steps k and l.

q. Set BATT SEL Switch to B5 position.

r. Repeat steps k and l.

s. Set BATT SEL Switch to B1x2 position.

t. Set AC-OFF switch to OFF position (AC PWR and BATT CHARGE OFF indicators extinguish).

2.2.3 ELECTRONIC TIMER TEST AND ADJUSTMENT

Test and adjust the electronic timer as follows:

a. Connect sequencer assembly to land-recovery-system test set (GSFC drawing number GDZ-12-207C) as shown in Figure 2-1.

b. Connect external dc power supply to J13 on test set and adjust power supply for 27-vdc output, making sure BATT SET Switch is set to B1x2 position.

c. Using Figure 2-2, select a resistance corresponding to the required timer setting for first severance minus the time required to reach 50,000 feet (approximately 25 seconds) and record time and resistance.

d. Adjust test set 1st SEV TIME potentiometer to resistance established in step c.

e. Set AC-OFF switch to AC position (AC PWR ON and BATT CHARGE OFF indicators illuminate).

f. Momentarily set SYSTEM RESET switch to LOOP position (LOOP 1 and LOOP 2 indicators illuminate, and extinguish when switch is released).

g. Set 20K SIM switch to 20K SIM position (20K SIM and K1 indicators illuminate).

h. Simultaneously set 50K SIM switch to 50K SIM position and start a stop watch (50K SIM and K2 indicators illuminate).

i. Observe first SEV (FWD and AFT), K5, K6, and BEACON PWR indicators (when indicators illuminate, stop the stop watch and observe elapsed time).

j. If time observed in step h is required time (±5 seconds), proceed to step k but if time is not within tolerance, adjust first SEV TIME potentiometer and repeat steps e through i until correct time (±5 seconds) is obtained.

NOTE

Increasing resistance of first SEV TIME potentiometer increases time. Decreasing resistance decreases time.

k. Set 50K SIM switch to down position (50K SIM indicator extinguishes).

l. Set 20K SIM switch to down position (2nd SEV [FWD and AFT], K3, and K4 indicators illuminate and K1 and 20K SIM indicators extinguish).

m. Momentarily set SYSTEM RESET switch to LOOP position (LOOP 1 and LOOP 2 indicators illuminate, and then extinguish when switch is released;

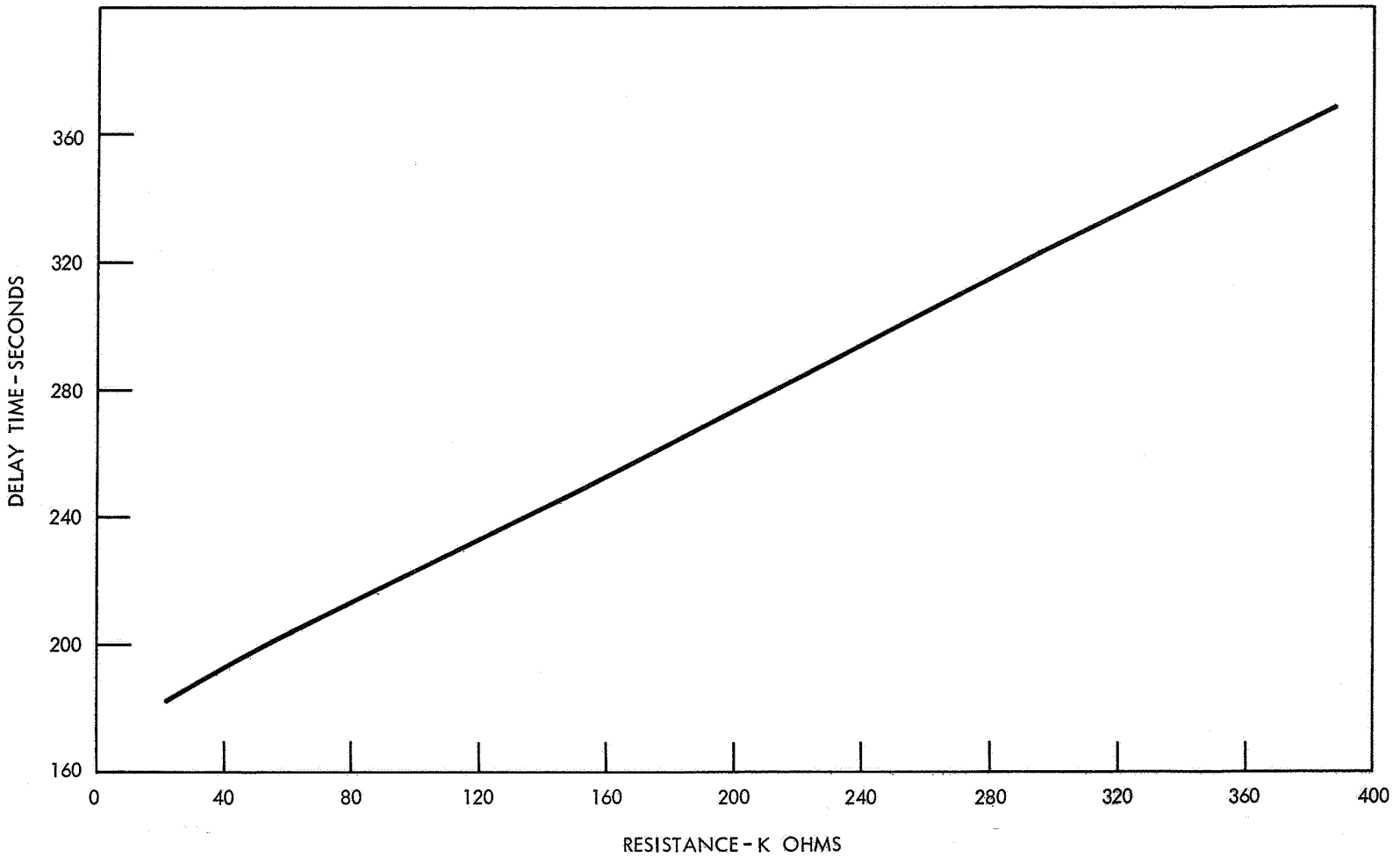


Figure 2-2. Timing Chart

all indicators except BEACON PWR, K5, K6, AC PWR ON, and BATT CHARGE OFF are extinguished).

n. Momentarily set BEACON-RESET switch to RESET position.

o. Set AC-OFF switch to OFF position (all indicators are extinguished).

p. Remove P7 from J7 on sequencer assembly.

q. Select standard resistor (±5 percent) of same resistance indicated on 1st SEV TIME potentiometer.

r. Connect selected resistor between P7-A and P7-B.

s. Connect P7 to J7 on sequencer assembly.

t. Repeat steps e through i.

u. If time observed in step i is same as required time (±5 seconds), proceed to step v but if elapsed time is too great, decrease value of resistor and repeat steps e through i (if elapsed time is too little, increase value of resistor and repeat steps e through i).

v. Repeat steps k through o.

w. Solder the selected resistor (q) between P7-A and P7-B.

x. Repeat steps e through i and record elapsed time.

y. Repeat steps k through n.

z. Repeat steps f through i and record elapsed time.

aa. Repeat steps k through n.

ab. Repeat steps f through i and record elapsed time.

ac. Repeat steps k through o.

ad. If time recorded in steps x, z, and ab are the same as required time (±5 seconds), disconnect external dc power supply and pot resistor on P7 using RTV 731 or equivalent.

ae. Disconnect land-recovery-system test set.

2.2.4 VACUUM-CHAMBER TEST

Perform the following test to ensure proper operation of the barometric sensing unit:

a. Connect sequencer assembly to altitude-chamber checkout box (GSFC drawing number GAZ-12-178) as shown in Figure 2-3.

b. Disconnect P7 from J7 and connect shorting connector to J7.

c. Place sequencer assembly and checkout box in a standard bell jar.

NOTE

Ensure that face of checkout box can be seen from outside of bell jar.

d. Close and secure bell jar.

e. Commence evacuation of bell jar.

f. Record altitude when 20K indicator on checkout box illuminates (altitude should be 20,000 ±2000 feet).

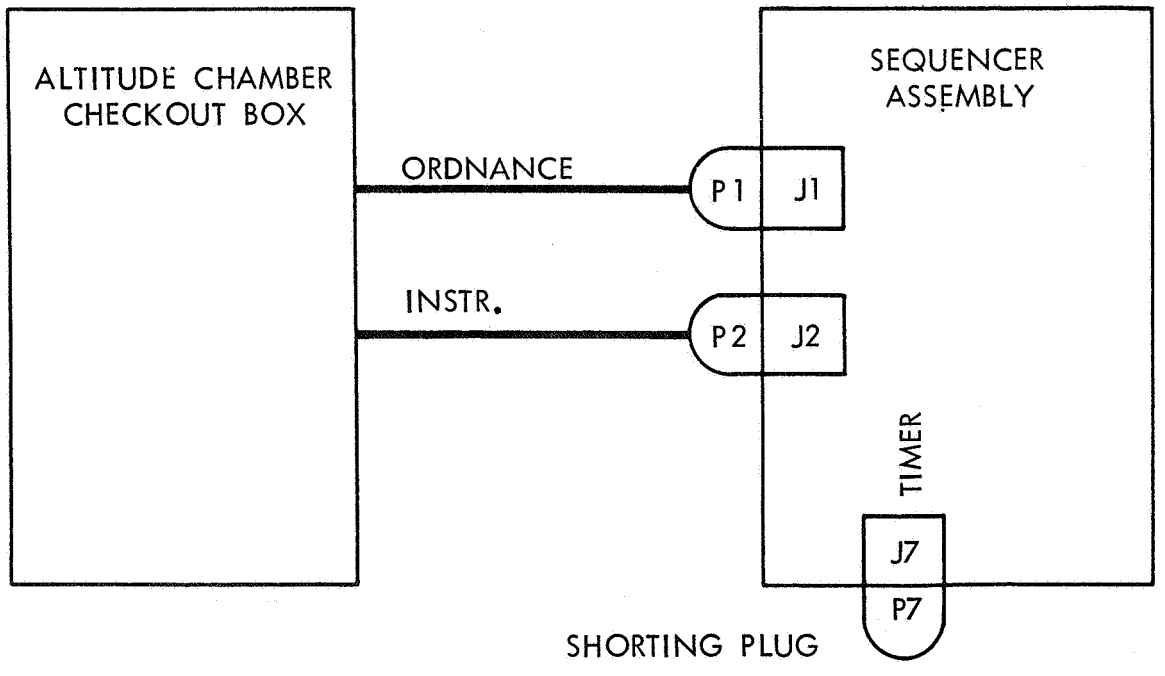


Figure 2-3. Vacuum-Chamber Test Setup

g. Record altitude and start stopwatch when 50K indicator on checkout box illuminates (altitude should be 50,000 ±4000 feet).

h. Stop the stopwatch and record elapsed time when first SEV indicator on checkout box illuminates (elapsed time should be 170 ±10 seconds).

i. Slowly vent bell jar to atmospheric pressure.

j. Record altitude when second SEV indicator illuminates (altitude should be 20,000 ±2000 feet).

k. When bell jar has vented, remove sequencer assembly and checkout box.

l. Press RESET switch on checkout box (all indicators extinguish).

m. Disconnect checkout box from sequencer assembly.

n. Disconnect shorting plug from J7 and connect P7 to J7.

2.2.5 ASSEMBLY

Assemble the recovery system as follows:

a. Clean adapter-ring threads.

b. Attach sequencer assembly to parachute-assembly base plate using 6 screws and washers (file flat washers as required).

c. On sequencer assembly, connect P2 to J2.

d. Tie cable assembly to parachute cylinder, as shown in Figure 2-4.

CAUTION

If recovery system is equipped with antennas, care must be taken while assembling system to avoid damage to antenna connectors on inside of housing assembly.

e. Connect cables to antenna connectors (if unit is so equipped) on inside of housing assembly.

f. Carefully slide sequencer assembly and parachute assembly (sequencer assembly first) partially into aft end of housing assembly.

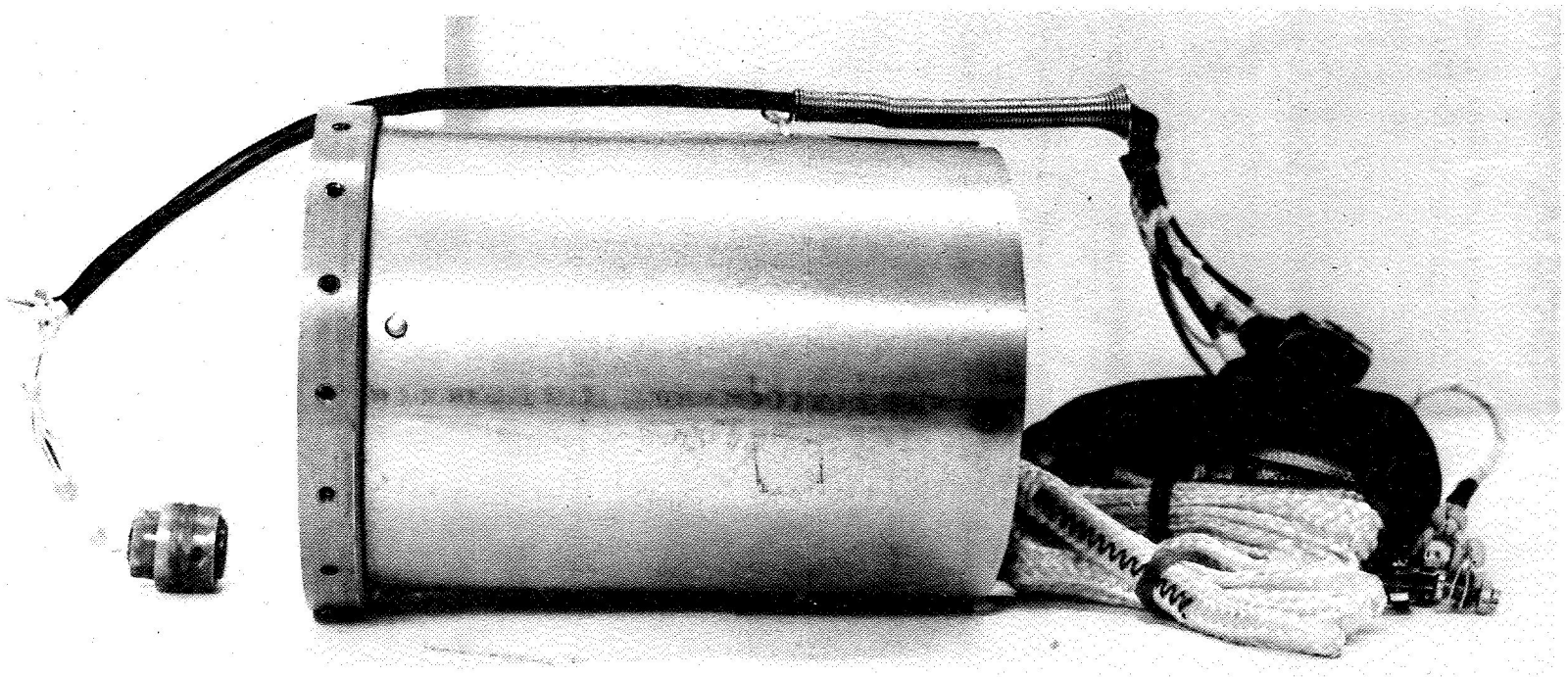


Figure 2-4. Cable Assembly Attached to Parachute Cylinder

g. Align 14 holes in housing assembly with 14 holes in parachute-assembly base plate and install but do not tighten screws.

h. Apply anti-seize compound to threads on forward adapter ring and severance-section assembly (this lubricant should be applied only to male threads which mate with housing assembly).

i. Screw forward adapter ring onto forward end of housing assembly but do not tighten.

NOTE

Ensure that drogue chute does not rotate during assembly.

j. Screw severance-section assembly to aft end of housing assembly and tighten both sections.

k. Tighten 14 screws in housing assembly.

l. Connect drogue-chute lines to inside of aft cover plate.

m. Check clearance of drogue chute.

n. Attach aft cover plate to shaped-charge retaining ring, using 8 screws.

NOTE

Before shipping recovery system, all batteries must be discharged to 1 volt per cell minimum.

o. Checkout and adjustment procedures are now complete—recovery system is ready for shipment to the field, final checkout, and mating with rocket and payload.

Section 3
FIELD PROCEDURES

3.1 GENERAL

The following procedure must be performed before mating the recovery system to the payload and rocket. If any indication is not within tolerance, the procedure should be stopped and the fault corrected before continuing.

When a step in the procedure designates record, the required information should be recorded in the space provided on data sheet A1 shown in Appendix A.

3.2 PROCEDURE

a. Charge batteries at 20 to 25 ma for approximately 24 hours (B1 should be charged to 28 volts maximum; B2 thru B5 should be charged to 14 volts maximum, 1.4 volts per cell maximum).

b. Remove aft cover plate.

c. Connect sequencer assembly to land-recovery test set as shown in Figure 2-1.

CAUTION

Do not connect test set connector P7 to J7 on sequencer assembly. P7 on sequencer assembly must remain connected to J7 sequencer assembly.

d. Set test set AC-OFF switch to AC position (AC PWR and BATT CHARGE OFF indicators illuminate).

e. Set BATT SEL SW to B1x2 position (VOLTAGE MONITOR meter should indicate 26 volts minimum) and record voltage.

f. Set and hold BATT TEST switch to LOAD TEST position (after 30±5 seconds, VOLTAGE MONITOR meter should indicate 23 volts minimum) then release BATT TEST switch and record voltage.

g. Momentarily set BATT TEST switch to RESET position.

h. Set BATT SEL SW to B2 position.

i. Momentarily set BATT TEST switch to LOAD TEST position (LOAD TEST indicator illuminates).

j. Momentarily set BATT TEST switch to RESET position (LOAD TEST indicator extinguishes).

k. Set BATT SEL Switch to B3 position.

l. Repeat steps i and j.

m. Set BATT SEL Switch to B4 position.

n. Repeat steps i and j.

o. Set BATT SEL Switch to B5 position.

p. Repeat steps i and j.

q. Set BATT SEL Switch to B1x2 position.

r. Connect external dc power supply to J13 on test set and adjust power supply for 27-vdc output.

s. Refer to data sheet A1, step c of Paragraph 2.2.3, to obtain required timer setting.

t. Momentarily set SYSTEM RESET switch to LOOP position (LOOP 1 and LOOP 2 indicators illuminate, and then extinguish when switch is released).

u. Set 20K SIM switch to 20K SIM position (20K SIM and K1 indicators illuminate).

v. Simultaneously set 50K SIM switch to 50K SIM position and start a stopwatch (50K SIM and K2 indicators illuminate).

w. Observe first SEV (FWD and AFT), K5, K6, and BEACON PWR indicators and when indicators illuminate, stop the stopwatch and record elapsed time (elapsed time should be same as time noted in step s [±5 seconds]).

x. Set 50K SIM switch to down position (50K SIM indicator extinguishes).

y. Set 20K SIM switch to down position (second SEV (FWD and AFT), K3, and K4 indicators illuminate; K1 and 20K SIM indicators extinguish).

z. Momentarily set SYSTEM-RESET switch to LOOP position (LOOP 1 and LOOP 2 indicators illuminate, and then extinguish when switch is released; all indicators except BEACON PWR, K5, K6, and AC PWR ON, and BATT CHARGE OFF are extinguished).

aa. Momentarily set BEACON-RESET switch to RESET position (BEACON PWR, K5, and K6 indicators extinguish).

ab. Repeat steps v through ac two times for repeatability (record elapsed time for timer).

ac. Set test set AC-OFF switch of OFF position.

ad. Disconnect external dc power supply.

ae. Disconnect land-recovery test set.

af. Install detonators as follows:

WARNING

Failure to follow the sequence of the following procedure could result in premature detonation of the severance-section assembly.

(1) Check resistance between pins A and B on connector P2 to ensure short circuit exists.

(2) Repeat step (1) on connectors P3, P4, and P5.

(3) Remove shorting foil and, using range-approved tester (Alinco 101-5BF or equivalent), measure detonator resistance and record detonator model number, serial number, and resistance on data sheet (resistance should be 1.0 ±0.1 ohms).

(4) Connect volt-ohm meter (Simpson or equivalent), on 50-μa scale, between P2-A and P2-B (result should be a zero-volt indication).

(5) Connect volt-ohm meter between P2-A and ground (result should be a zero-volt indication).

(6) Connect volt-ohm meter between P2-B and ground (result should be a zero-volt indication).

(7) Repeat steps (4), (5), and (6) for connectors P3, P4, and P5.

WARNING

If a voltage indication is obtained in steps (4), (5), (6), or (7), do not continue with procedure: failure to comply could result in premature detonation of severance-section assembly.

(8) Verify shorting foil has been removed from the four detonators, and initial data sheet A1 in provided space.

(9) Screw and tighten detonators into four detonator receptacles on inside of severance-section assembly.

CAUTION

If cables to first and second severance detonators are reversed during installation, system will malfunction in flight.

ag. Connect the two 2nd SEV FWD connectors (P2 and P3) to forward detonators.

ah. Connect the two 1st SEV AFT connectors (P4 and P5) to aft detonators.

ai. Ensure that in-flight cable-separation connectors are carefully positioned at right angles to the thrust axis, then install aft cover plate.

aj. Apply Glyptol to eight screws on aft cover plate.

ak. Complete data sheet A3 in Appendix A.

al. Recovery system is now ready for mating to the rocket and payload.

APPENDIX A
DATA SHEETS

This appendix contains the data sheets necessary for recording the results of the various recovery-system tests and adjustments. Data sheet A1 is used during the initial checkout and adjustment, and during the field procedures. Data sheet A2 is used to record battery load-test data. Data sheet A3 is used to record center-of-gravity information.

DATA SHEET A1

INITIAL CHECKOUT AND FIELD PROCEDURES
CAPACHE PAYLOAD RECOVERY SYSTEM

Part No. _____
Serial No. _____

PARAGRAPH	RESULT
2.2.1 k	Serial number _____ Frequency _____
l	Technician _____ Date _____
2.2.2 g	Voltage = _____
h	Voltage = _____
2.2.3 c	Rt = _____
x	t = _____
z	t = _____
ab	t = _____
2.2.4 f	Altitude = _____
g	Altitude = _____
h	Time = _____
j	Altitude = _____
	Technician _____ Date _____
3.2 e	Voltage = _____
f	Voltage = _____
w	Time = _____
ab	Time = _____
	Time = _____
af (3)	#1 1st Sev Aft R = _____ Model No. _____ Serial No. _____
	#2 1st Sev Aft R = _____ Model No. _____ Serial No. _____
	#3 2nd Sev Fwd R = _____ Model No. _____ Serial No. _____
	#4 2nd Sev Fwd R = _____ Model No. _____ Serial No. _____
af (8)	Shorting foil removed _____

DATA SHEET A2

BATTERY CHARGING AND TEST
CAPACHE PAYLOAD RECOVERY SYSTEM
(Paragraph 2.2.2)

BATTERY UNIT S/N:

NAME _____

B1A _____ B1B _____ DATE _____
B2 _____
B3 _____ Part No. _____
B4 _____
B5 _____ Serial No. _____

STEP	(MINUTES)	B1	B2	B3	B4	B5
C (1)	0					
C (2)	0					
C (3)	1					
C (4)	3					
C (5)	5					
C (6)	10					
	15					
	20					
	25					
	30					
	35					
	40					
	45					
	50					

DATA SHEET A3

CENTER OF GRAVITY INFORMATION

CAPACHE Payload Recovery System

Name _____ Date _____

Rocket Number _____

Payload Length _____

Payload Diameter _____

Payload Weight _____

Nose-Cone Half Angle _____

CG From Aft End _____

First Severance Time _____

First Severance Altitude _____

APPENDIX B

PARTS LIST AND SPECIFICATIONS

TIMER (TEMPO), Model 92361

Input voltage (nominal)	24 vdc
Input voltage (range)	18 to 31 vdc
Current drain at 24 vdc and 25°C	20 ma maximum before pickup. 200 ma maximum after pickup.
Contact ratings	10 amp resistive, 5 amp inductive; at 25 vdc, 115 vac, 60 to 400 Hz
Contact resistance	as specified in MIL-R-5757D
Time delay	delay on pickup, adjustable from 170 sec to 500 sec
Time-delay accuracy	2 percent of nominal set value under all input voltage and environmental conditions
Release time	20 ms maximum
Dielectric withstanding voltage at high altitude	100v rms, all terminals and case 60 Hz; 500v rms, 60 Hz between open-relay contacts
Insulation resistance	100 meg minimum at 500 vdc and 25°C between all terminals and case
Shock	50g, 1 ms
Temperature and humidity	2 hours at -18°C, 4-hour transition to +121°C, 2 hours at +121°C and 90 percent relative humidity.

OPTIONAL RADIO-BEACON TRANSMITTER, CTB-202-03 (CONIC CORP)

Frequency range	215 to 260 MHz (400 to 406 MHz optional) crystal-controlled
Frequency stability	0.01 percent (0.005 percent optional)

Power output	150-mw minimum when operating into 50-ohm load over specified temperature range and input voltage
Power requirements	24 to 32 vdc at 35 ma maximum, or 12.5 to 14.5 vdc at 50 ma maximum
Construction	printed circuit board mounted in aluminum housing, encapsulated for rugged environments
Temperature range	-30°C to +80°C
Acceleration	100g in each axis
Shock	100g, half sine, 11 ms in each axis
Vibration	20g peak, 20 to 200 Hz in each axis
Altitude	orbital
Size	3.5 cubic inches
Diameter	2-1/8 inches
Height	1.06 inches maximum
Weight	less than 3 ounces

BATTERY, TYPE 10VO.250P (GULTON INDUSTRIES)

Capacity	250 ma-hr
Nominal voltage	12v
Diameter	1.5 inches
Length	2.45 inches

RELAY, MODEL BR7X-300-D7 26V (BABCOCK)

Vibration	30g, 40 to 2000 Hz
Shock	50g, 11 ms
Dielectric strength	BR-7X, 1250v rms
Insulation resistance	10,000 meg at 25°C; 1000 meg minimum at 125°C

Life	100,000 operations/min at 125 degrees to MIL-R-5757D
Temperature range	-65°C to +125°C to MIL-R-5757D
Duty	continuous
Contact rating	10 amp resistive at 23 vdc or 115 vac, 400 Hz
Derate	50 percent for inductive loads
Contact form	DPDT
Overload rating	35 amps
Contact arrangement	DPDT or SPDT
Maximum coil dissipation	3 watts
Minimum pull-in power	80 mw to 500 mw (50 mw available by derating environmental specifications)
Normal adjustment (Maximum Difference)	drop-out, 10 percent of pull-in minimum
Special adjustment (Minimum Difference)	drop-out, 40 percent of pull-in minimum
Weight	approx 1.1 ounce
Military specifications	meets MIL-R-5757D and MIL-R-25018
Bounce time	2 ms maximum at rated load

RELAY, MODEL BR17A-F7-V2 (BABCOCK)

Contact rating	2 amps, 32-vdc resistive; 1 amp 115v 400-Hz resistive (case not grounded); 1/4 amp (case grounded); 1/2 amp inductive, 32 vdc; contact resistance, 0.05 ohms maximum
Dry circuit	1 μa at 1 mv; contact resistance, 100 ohms maximum
Contact arrangement	DPDT
Contact material	silver magnesium nickel, gold-plated

Bobbin material	Teflon
Life	low level: more than 5,000,000 operations at 125 degrees rated load: 100,000 operations at 125°C, per MIL-R-5757D
Shock	50g, 11 ms
Vibration	30g, 30 to 2000 Hz; 10 to 40 Hz at 0.4 inch, double amplitude
Acceleration	200g minimum
Temperature range	-65°C to +125°C
Duty	continuous
Dielectric strength	sea level—1000v rms, 750v rms across contacts; 500v rms between dual coils; 70,000 ft: 450v rms
Insulation resistance	10,000 meg minimum at 25°C, 1000 meg minimum at 125°C
Operate time	3 ms maximum at nominal power
Contact bounce	2 ms maximum
Pull-in power	175-mw dual coil, 90-mw single coil
Reliability	predicted failure rate less than 0.1 percent in 10,000 operations with 90 percent confidence factor
Military specifications	meets or exceeds MIL-R-5757D/9
Enclosure	solderless, fluxless, hermetic all-welded seal. Back filled with 90 percent dry nitrogen and 10 percent dry helium; leak rates: less than 10-8cc/sec of helium
Weight	approximately 0.25 ounce

RELAY, MODEL BR-32-450-B4 26V (BABCOCK)

Contact rating	2 amps, 32 vdc resistive; 1 amp 115v, 400 Hz resistive (case not grounded);

	1/4 amp (case grounded); 1/2 amp inductive, 32 vdc; contact resistance, 0.05 ohms maximum
Dry circuit	1 μa at 1 mv; contact resistance, 100 ohms maximum
Contact arrangement	DPDT
Contact material	silver magnesium nickel, gold plated
Bobbin material	Kel-F-81
Life	low level: more than 5,000,000 operations at 125 degrees
Shock	50g, 11 ms, standard (125g, 11 ms, special)
Vibration	30g, 60 to 2000 Hz; 10 to 40 Hz at 0.4 inch, double amplitude, standard (20g, 40 to 3000 Hz, special)
Acceleration	200g minimum
Temperature range	-65°C to +125°C
Duty	continuous
Dielectric strength	sea level—1000v rms, 750v rms across contacts; 70,000 feet—450v rms
Insulation resistance	10,000 meg minimum at 25°C, 1000 meg minimum at 125°C
Operate time	4 ms maximum at nominal power
Release time	4 ms maximum
Contact bounce	2 ms maximum. Less than 1 ms special request
Adjustment differential	drop-out 10 percent of pull-in at 25°C
Pull-in power	350 mw
Reliability	predicted failure rate less than 0.1 percent in 10,000 operations with 90 percent confidence factor

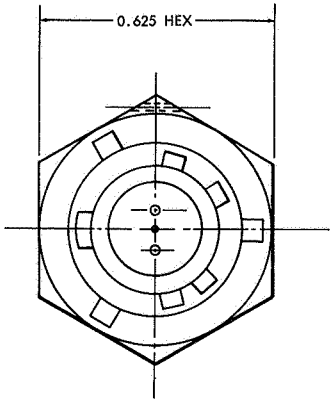
Contamination preventative . .	approximate chemical composition of dry Vycor thirsty glass is 96 percent SiO_2, 3 percent B_2O_3, less than 1 percent R_2O_3, and a trace of alkali. Average pore diameter is 4 mmu and void space is 28 percent of volume. Internal surface area is 150 to 200 $\overline{sm}$ per gram
Military specification	Meets MIL-R-5757D/9
Enclosure	Solderless, fluxless, hermetic all-welded seal. Back filled with 90 percent dry nitrogen and 10 percent dry helium; leak rates—less than 10-8cc/sec of helium
Weight	Approximately 0.25 ounce

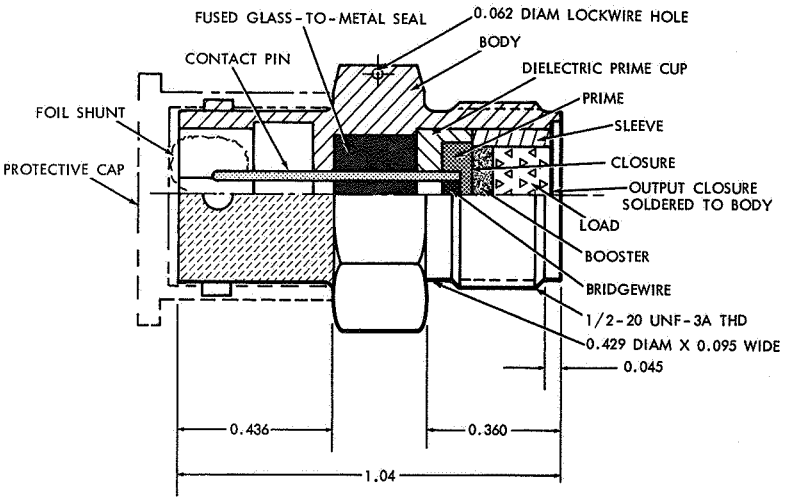
ALTITUDE SWITCH, ES4-20 (ERICKSON SPECIALTIES)

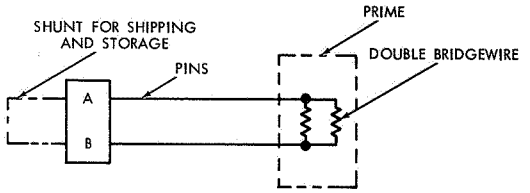
Weight	0.65 oz
Contact capacity	0.5 amp at 28v inductive load
Nominal altitude	20,000 ±2000 feet

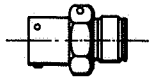
ALTITUDE SWITCH, ES4-50 (ERICKSON SPECIALTIES)

Weight	0.65 oz
Contact capacity	0.5 amp at 28v inductive load
Nominal altitude	50,000 ±4000 feet









NOTES:

1. FIRING DATA:

   NO-FIRE CURRENT — 1.0 AMP FOR 5 MIN.
   NO-FIRE WATTAGE — 1.0 WATT FOR 5 MIN.
   ALL-FIRE CURRENT — 4.5 AMPS MIN.
   FUNCTIONING TIME — 15 MILLISECONDS WITH 4.5 AMPS APPLIED.
   BRIDGEWIRE RESISTANCE — 1.0 ± 0.1 OHMS
   DIELECTRIC STRENGTH — 1000 VOLTS DC RMS MAX.
   PIN-TO-CASE RESISTANCE — 2 MEGOHMS MIN AT 500 VDC.

2. MATERIAL AND FINISH DATA:

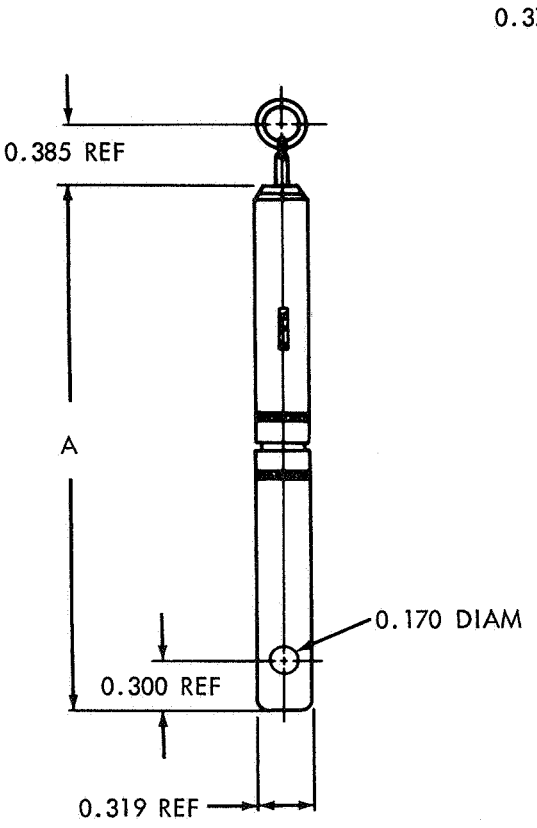
   BODY — B1113/C1010 STEEL; } GOLD PLATED PER MIL-G-45204,
   CONTACT PINS — C1010 STEEL } TYPE 1, CLASS 4
   OUTPUT CLOSURE — C1010 STEEL; TIN PLATED PER M+L-T-10272, TYPE I

3. UNIT DESIGNED TO MATE WITH BENDIX PT06-8-2S CONNECTOR OR EQUIVALENT.

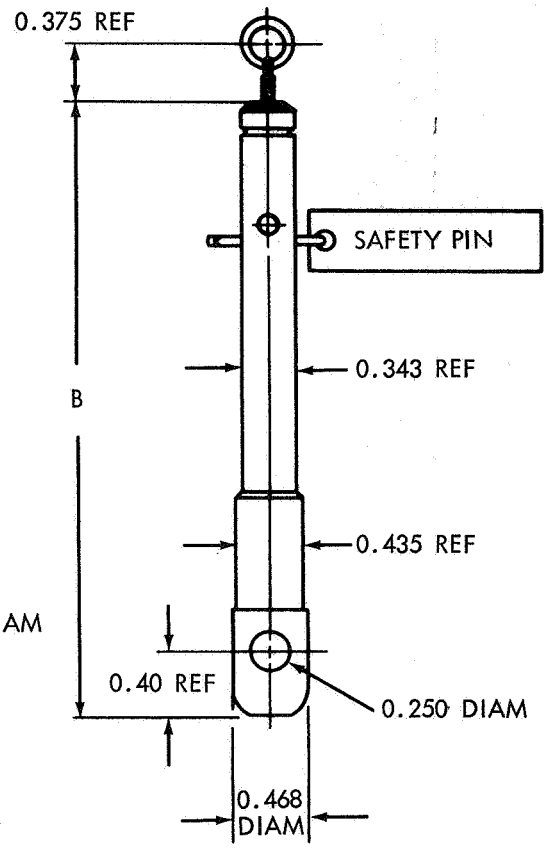
4. THE FOLLOWING IS RUBBER STAMPED ON HEX FLATS "HOLEX 5904, SERIAL NO. PER MANUFACTURING ORDER, AND LOT NO."

Figure B-1. Detonator, Model 5904

DELAY	0-6 SEC	7-12 SEC
"A"	3.26 REF	4.26 REF
"B"	3.83 REF	4.83 REF



D-1SE152



D-1SE153

NOTES:

SAFETY PIN PULL	15±6 POUNDS AT AMBIENT TEMPERATURE
ALTITUDE	100,000 FEET MAXIMUM
TEMPERATURE	-65°F TO +160°F
HUMIDITY, SHOCK, VIBRATION, ACCELERATION	MEETS MIL-E-5272C
OUTPUT CHARGE	LEAD AZIDE
DELAY MIX	ZIRCONIUM-NICKEL
PRIMER	M-42

Figure B-2. Reefing-Line Cutter